Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-728-RC1, 2019

Atmospheric Chemistry and Physics Discussions

Interactive comment on "A transition in atmospheric emissions of particles and gases from on-road heavy-duty trucks" *by* Liyuan Zhou et al.

Anonymous Referee #1

Received and published: 5 November 2019

General comments

This paper uses fast roadside measurements of a range of gaseous and particulate emissions for heavy duty vehicles in Sweden. A relatively large sample size of measurements is used to infer the emission characteristics of different vehicle types - mostly by Euro status. The paper provides an up to date understanding of the evolution of emissions of important species that include non-regulatory species. The paper is generally well-written but perhaps lacks a clear explanation of what the new findings are and how they differ from previous work. Indeed, the size of Table 1 and 2 indicate that a considerable amount of work has been carried out before in this area. Nevertheless,

emissions from road vehicles continually evolve and on balance I think this study does contribute some useful, up to date emissions from an important class of vehicles.

Specific comments

Line 254 where it is stated non-Swedish trucks tend to have higher emissions. I think this statement needs to be more robust. As the authors point out, there is no Euro class information for non-Swedish trucks (and therefore no knowledge of the numbers in each Euro class). Given the large range of emissions by Euro status, I don't think this statement is particularly defensible. Furthermore, all the data shown in Table 1/2 I think have overlapping 95% CI when making this comparison. Also, the statement "which may be attributed to the more stringent domestic goals regarding pollution, clean air, greenhouse gas emissions, energy efficiency, and innovative sustainable solutions..." is vague. Is it the case that Swedish annual technical inspections are more stringent than other countries? I doubt there is evidence for that.

How sure can the authors be that certain Euro classes of vehicles have certain technologies fitted? For example, is it known that any of the tested vehicles were retrofitted in some way?

Where comments are made about decreases (or changes in general) I think it is important to provide the corresponding uncertainty. It seems that in many cases that there will be overlapping confidence intervals and therefore important to convey where differences are statistically clear or not.

How was the sigma of the background component of CO2 calculated? This was not based on upwind measurements, right? Presumably the variation in background cannot be represented by a single value and it varies also. Some more details are needed. It would be helpful to have a Figure that shows a 'typical' peak being analysed showing the concentration of CO2 and all other species. This would also help demonstrate that a measurement frequency of $\sim$1 Hz is sufficient to capture an individual vehicle plume. Moreover, a discussion on the effect of sampling rate (and potentially different sampling

rates) on the on the extracted plume characteristics / metrics would be beneficial.

Do the authors have any information about the engine type or manufacturer to understand whether that is an important factor that could explain some of the differences observed? Earlier on in the text it is stated that these types of factor can be important in determining emissions, so it would b euseful to explain this. Similarly, is there any difference in the size of vehicle sampled (e.g. by engine size or kerb weight)?

Section 4 (Atmospheric implications and conclusions) does not actually consider the atmospheric implications. I think it should - and if it did - it would strengthen the paper. For example, it would be useful to consider the implications for near-road exposures, and consider how UFP could evolve through coagulation etc. as plumes disperse away from roads. Reducing PM mass is clearly important but if the consequence in doing so increase PN, then that could be important.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2019-728, 2019.